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TYPE STUDIES IN THE HYDNACEAE[1]—V. THE GENUS HYDNELLUM.

HOWARD J. BANKER

Hydnellum Diabolus sp. nov.

Hydnum carbunculus (Secr.) Banker, Mem. Torrey Club **12**: 151. 1906; not *Hydnum carbunculus* Secr., Myc. Suis. **2**: 515. 1833.

Hymenophore terrestrial, mesopodous, gregarious, more or less confluent, low, nearly sessile, broad; pileus convex to plane, rarely slightly depressed in center, more or less uneven, somewhat round to irregular, 4–10 cm. wide and by confluence often 20 cm. wide; surface wooly pubescent, often more or less floccose squamulose, azonate, whitish at first turning slightly brownish with irregular blotches of dark-brown to nearly black where bruised, these latter spots more or less glabrous, shining, probably from the dried juice; substance fibrous, tough, spongy, grayish-brown in the upper part of the pileus, compact, hard, somewhat woody, more or less distinctly zonate in the lower part, exuding a thick red juice in the fresh plant; margin somewhat thick, obtuse, subfertile to sterile; stem stout, very short, deformed, becoming bulbous in the substratum, and sometimes subradicating, 1–3 cm. wide, 1 mm. to 1 cm. long above ground; teeth slender, terete, tapering, acute, decurrent, pinkish white, less than 5 mm. long shortening to the margin, about 3–5 to a sq. mm.; spores ovoid, tuberculate, brownish, 4–5.5 μ wide; hyphae of pileus hyaline, smooth, thin-walled, collapsing when dried, recovering quickly in KOH, forming a somewhat intricate tangle but with a decided tendency to run longitudinally, separable in KOH, septate with simple clamp-connections, segments extremely long, slender, uniform, 3–4 μ wide, branching diffuse; odor of hickory nuts, strong; taste intensely acrid.

On the ground under conifers in autumn.

The type specimen of this species was collected at Mt. Desert,

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Maine, by Miss V. S. White, No. 148, and deposited in the herbarium of the New York Botanical Garden. The species is found distributed more or less sparingly from Maine to Alabama. The following specimens appear to belong here: Maine, *White;* New Jersey, *Ellis;* Maryland, *Shear;* Alabama, *Earle.* The species is also represented by many of the specimens in the following exsiccati under the name *Hydnum ferrugineum* Fries: Ellis, N. Am. Fung. 928; and Shear, Ell. and Everh. Fung. Columb. Cont. 1409.

In our previous paper, *loc. cit.,* we identified our American plants with Secretan's species solely on the basis of his description. The type of *H. carbunculus* Secr. has not been located and probably is not in existence. No specimens were found in European herbaria referred to his species, and it seems probable that the name is not there recognized as anything more than a synonym of *H. ferrugineum* Fries Secretan himself evidently regarded his species as the same as *H. ferrugineum* Fries and proposed the name on the ground that Fries's name was preoccupied by *H. ferrugineum* Pers. His description, however, does not accord well with authentic specimens of the Friesian species, but does apply well to our American plants.

On the other hand, our plants appear to be entirely distinct from any European forms, as but one doubtful specimen was found in Europe that seemed to show any affinity with the American species. That was a specimen at Upsala received from Karsten and referred to *H. ferrugineum* Fries but was evidently quite different from authentic specimens of that species in the same herbarium. It was not, however, any nearer to our American forms. A specimen from Bresadola in the New York Botanical Garden Herbarium and referred by him to *H. ferrugineum* Fries also somewhat approaches in appearance the American plants but is clearly not the same.

Although Secretan's description is admirably adapted to our American forms, it seems best to treat the American segregation as a distinct species for which we now propose a specific name. Our grounds for this decision are: first, the fact that both by himself as well as by other European mycologists Secretan's species was regarded as equivalent to *H. ferrugineum* Fries; second, this fact combined with the lack of any specific type is sure to involve any forms referred to Secretan's species in confusion with the Friesian species; third, the Friesian species itself, as we believe, is of doubtful standing and further confusion is likely to be involved with its synonyms; finally, the American form does not appear to be represented in Europe and there is, therefore, reason for serious doubt if Secretan really described the American species.

HYDNELLUM VELUTINUM (Fries) Karst. Medd. Soc. Faun. et Flora Fenn. **5**: — (27). 1879

Hydnum velutinum Fries, Sys. Myc. **1**: 404. 1821.
Hydnum spongiosipes Peck, Ann. Rept. N. Y. State Mus. **50**: 111. 1897.

No specimen whatever referred to *Hydnum velutinum* Fries was found at Upsala. There is probably, therefore, no type specimen of this species. At Berlin no specimens were found under this name except a couple of American plants sent by Atkinson. At Paris, besides a specimen from Massachusetts collected by Sprague, there was only one other specimen which had been collected in "Nantes." At Kew, England, a considerable number of specimens were found under this name, many of which were identical with the American *H. spongiosipes* Pk. as were also the specimens at Berlin and Paris. The latter species is, therefore, evidently a European species though apparently rare on the continent and is known to the European mycologists as *Hydnum velutinum* Fries with the description of which it fully accords.

HYDNELLUM SCROBICULATUM (Fries) Karsten, Medd. Soc. Faun. et Fl. Fenn. **5**: — (27). 1879

Hydnum scrobiculatum Fries, Obs. Myc. **1**: 143. 1815.
Hydnum ferrugineum Fries, Obs. Myc. **1**: 133. 1815; not *H. ferrugineum* Pers. Tent. disp. Meth. Fung. 30. 1797.
Hydnellum sanguinarium Banker, Mem. Torrey Club **12**: 152. 1906.

No type specimen of *Hydnum scrobiculatum* Fries was to be found in the herbarium of Fries at Upsala. Plants referred to this species at Upsala as well as in most other European herbaria are quite variable and show the usual confusion with the closely related species. In general, however, the interpretation of the species by European mycologists appears to be identical with that set forth by the writer in a former paper.[2]

Hydnum ferrugineum Fries as represented at Upsala by specimens of as early a date as 1849 and 1866 does not appear to differ essentially from many of the specimens also there referred to *H. scrobiculatum.* These forms, however, we would refer to *H. hybridum* Bull. Fries himself in the Systema Mycologicum **1**: 403 cites *H. hybridum* Bull. as a synonym, but later in the Epicrisis Systematis Mycologici he identified Bulliard's species with his own *H. velutinum* with the emphatic remark "Omnino hoc." A study of Fries's descriptions of *H. ferrugineum* conveys the impression of changing conceptions. In the Observationes Mycologici **1**: 133 where the original description is found the species does not appear to differ greatly from our conception of *H. velutinum.* In the Systema Mycologicum *l. c.* the description is far more applicable to the forms which we have regarded as *H. scrobiculatum.* His figure in the Icones Selectae Hymenomycetes *pl. 5. f. 1*, is an excellent representation of what we regard as *H. scrobiculatum.* As to the red juice of which much has been made in later years we do not believe it to be a constant character as we have seen plants that appeared to differ in no other way with clear watery juice, with juice of a pinkish tinge, and with juice that the collector stated was "blood red."

On the basis of the specimens at Upsala, the determination of which from their early date may be regarded as approved by Fries, one would perhaps be justified in treating *H. ferrugineum* Fries as a synonym of *H. hybridum* Bull. but the plants do not accord well with the descriptions and figures. It is perhaps fortunate that *H. ferrugineum* Fries is untenable and that the name must be treated as a synonym, but it is difficult to decide whether it is better regarded as a synonym of *H. scrobiculatum* Fries or of *H. hybridum* Bull. On the whole, we incline to the view that it pertains to the former.

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[2] Mem. Torrey Club **12**: 156. 1906.

Hydnellum sanguinarium Banker was proposed as a substitute for the untenable *Hydnum ferrugineum* Fries at a time when we regarded the red juice as having much weight in the separation of species. As treated by us in the work cited it differs in no other essential particulars from our treatment of *H. scrobiculatum* Fries.

Hydnellum hybridum (Bull.)

Hydnum hybridum Bull. Hist. Champ. Fr. 307. 1791.
Hydnum Queletii Fries, Quél. Champ. Jura Vosg. 277. 1872.

There is no type of *H. hybridum* Bull. in existence and our forms are referred here solely on the basis of Bulliard's description and figures. The radiating rugae appear to be the most characteristic feature of the segregation. This character, however, is sometimes obscure and it is then difficult to distinguish the plants from *H. scrobiculatum.*

The type of *H. Queletii* is preserved in the herbarium at Upsala and is a typical specimen of the segregation which we refer to *H. hybridum* Bull., having the radiate rugae especially well developed. The plants of this segregation have been quite commonly referred to *H. scrobiculatum* by the most eminent mycologists, often to *H. zonatum* Batsch, and even apparently by Fries himself to *H. ferrugineum* Fries.

Hydnellum Vespertilio (Berk.)

Hydnum Vespertilio Berkeley, Hooker's Jour. Bot. and Kew Gard. Miscel. **6**: 167. 1854.

In the original description of this species Berkeley emphasized the fact that it was black and suggested a possible relationship to *Hydnum nigrum* Fries. This was misleading and, as the description was based on specimens from India and suggested no American forms, little attention was paid to it. In searching through the Berkeley Herbarium at Kew, however, specimens were found marked according to notes taken at the time "Hydnum vespertilio, Berk. Nunklow July 10, 1860." These specimens were at once recognized as similar to certain undetermined American forms belonging in the genus *Hydnellum.* They are undoubtedly the type of Berkeley's species as that author cites for his type specimens "Nunklow. July 10, 1850." At the time of taking my notes I doubtless mistook the 5 in the year date for a 6 and just then I had no reference to Berkeley's original description for comparison.

The specimens at Kew although very dark are not black and are clearly typical examples of the genus *Hydnellum,* being very near *H. hybridum* and *H. zonatum.* The American forms that belong here have been, doubtless, generally referred to *H. zonatum.* Berkeley's description fits our plants in every respect except for his unqualified statement that the species is black. Fresh living plants have the usual cinnamon-brown color of the related species, sometimes uniform, occasionally with the pink border characteristic of *H. zonatum.* One of the most distinctive features is the rows of scabrous, yellow dots that mark the zonations of the pileus. Old specimens are very dark and the writer has in his herbarium a collection gathered at Bolton, N. Y., that contains one or two old and apparently weathered specimens that are actually black. Nothing so dark was observed in the material at Kew, and we believe that the character pertains only to old dead specimens.

HYDNELLUM ZONATUM (Batsch) Karst. Medd. Soc. Faun. et Fl. Fenn. **5**: — (27). 1879

Hydnum zonatum Batsch, Elench. Fung. 111. 1783.
Hydnum concrescens Pers. Obs. Myc. **1**: 74. 1796.

There is no type specimen of *Hydnum zonatum* Batsch and our conception of the species is almost wholly dependent upon Batsch's description and figures.

In Persoon's herbarium at Leyden there are a number of specimens under the names *Hydnum concrescens* Pers. and *Hydnum cyathiforme* Bull. which are there treated as synonymous. None of these are probably to be regarded as type specimens although most of them may be considered as having their determination approved by Persoon. The principal set of these appears to be identical with the forms which we have referred to *H. concrescens* Pers.[3] Most of the other specimens are forms which we would refer to *H. hybridum* Bull. In the European herbaria referred the forms generally to *H. zonatum* Batsch are of these two types.

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[3] Mem. Torrey Club **12**: 157.

The American form which we have previously referred to this species we are now convinced is not a European plant. Nothing like it has been observed in any of the European collections. We, therefore, return to the prevailing view of the European mycologists and regard *H. zonatum* Batsch as synonymous with *H. concrescens* Pers. It is highly probable that *H. cyathiforme* Bull. should be regarded as of this segregation. At Paris, specimens from Desmazières are strictly of this type and are ascribed in common to *Hydnum cyathiforme* Bull., *H. concrescens* Pers., and *H. zonatum* Batsch.

Hydnellum parvum sp. nov.

Hymenophore terrestrial, mesopodous, gregarious, often confluent, small, cinnamon-brown with light margin; pileus subconvex to plane, umbilicate, or subinfundibuliform, irregular, thin, less than 1 mm. thick, 1.5–3 cm. wide; surface radiately fibrillose-striate, subpubescent, distinctly zonate with shades of brown, darker in the center, pink to nearly white toward the margin when fresh, but turning more or less uniform brown when dried; margin thin, acute, repand, more or less lacerate; substance darker and more compact than surface layer, azonate, thin; stem slender, subcylindrical, slightly bulbous at base with scarcely evident spongy tomentum, solid, pubescent, cinnamon-brown, 1–1.5 cm. long, 2–3 mm. wide; teeth slender, terete, tapering, acute, not decurrent, dark-brown, less than 1.25 mm. long, shortening towards margin and stem; spores subglobose, coarsely tuberculate, 3–4 μ wide, brown; hyphae colored brownish, transparent, smooth, somewhat thin-walled, collapsing when dried, recovering but partially in KOH, running distinctly longitudinally and interweaving into a compact layer, separable with difficulty in KOH, septate without clamp-connections, segments extremely long, slender, uniform in width, 3–4 μ wide, branches few, arising at a point about once or twice the width of the hypha below a septum and septate at about three or four times the width of the hypha above its origin.

On ground in dry woods, usually under conifers, in late autumn.

The type specimens were collected by Dr. L. M. Underwood in Alabama and are in the Underwood herbarium at Columbia University.

In a former work[4] these plants were referred to *Hydnellum zonatum* (Batsch) Karst. under a mistaken conception of that species which we have now corrected (see *H. zonatum* above). After a thorough search through a number of the most important European herbaria, we are convinced that the plants are not European forms and should be recognized as a distinct species. The plants do not appear to be common but have a wide distribution, specimens having been seen from New York, Alabama, and Michigan.

HYDNELLUM SUAVEOLENS (Scop.) Karst. Medd. Soc. Faun. et Fl. Fenn **5**: 27. 1879

Hydnum suaveolens Scopoli, Fl. Carn. **2**: 472. 1772.
Hydnum compactum Pers. Comm. Schaeff. 57. 1800.
Hydnum boreale Banker; White, Bull. Torr. Club **29**: 553. 1902.

There is no type specimen of Scopoli's species, but specimens in Europe referred here are generally of the same type as the forms previously described by the writer[5] under this name.

Hydnum compactum Pers. is represented in the Persoon herbarium at Leyden by several specimens some of which are labelled in Persoon's own hand. They do not appear to differ in any respect from the forms usually referred to *H. suaveolens* Scop.

The blue coloration of *H. suaveolens* appears to be quite variable in intensity and doubtless tends to fade with age. In old herbarium specimens it is usually faint. The odor likewise seems to vary in intensity and is probably sometimes nearly, if not wholly, lacking. While in some specimens it can be detected for years in most old herbarium specimens it has evidently disappeared. In the original description of *H. boreale* Banker, the odor was stated as unpleasant on the authority of Miss White's field notes. The odor of these plants is generally described as that of melilot. Such an odor if very strong would probably be unpleasant to some people.

Hydnellum Rickerii sp. nov.

Hymenophore terrestrial, mesopodous, scattered, or solitary, medium to large sized, dingy-brown or olivaceous; pileus depressed

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[4] Mem. Torrey Club **12**: 158. 1906.

[5] Mem. Torrey Club **12**: 163. 1906.

to subinfundibuliform, repand, somewhat uneven or rugose, round to slightly irregular, 12–20 cm. wide; surface glabrous, pelliculose, subrugose, dark-dingy-olive-brown near center to chestnut near margin, the coloring somewhat irregularly distributed; margin thin, incurved when dried; substance fibrous to subfleshy, thin, 2–4 mm. thick when dried, dingy-white or slightly tawny with a gradually increasing steel-blue toward center and in stem, homogeneous, azonate; stem short, excentric, with bulbous base; teeth slender, terete, subcylindrical, acute, decurrent, grayish-brown, 7 mm. or less long, shortening toward margin and stem, crowded, 7–9 to a sq. mm.; spores globose to ovoid, tuberculate, pale-brown to hyaline, 3–4 μ wide; hyphae of the pileus hyaline to pale-yellowish, smooth, thin-walled, collapsing when dried, recovering quickly in KOH, running longitudinally but interweaving into a close tangle, separable in KOH with some difficulty, rarely septate with simple clamp-connections, segments extremely long, slender, uniform, 5–6 μ wide, scarcely any branching; odor very strong aromatic with a suggestion of melilot.

The type specimen was collected in Orono, Maine, by P. L. Ricker, No. 173, and is in the writer's herbarium. Part of the same collection is in Mr. Ricker's possession and I believe a specimen is with Prof. Farlow at Harvard University.

While the species approaches *H. suaveolens* in several particulars it differs conspicuously in the darker color of the pileus, the character of the substance which is more nearly fleshy and does not dry hard and woody as in *suaveolens,* and the fragrant, spicy odor. The odor of this plant is the most remarkable of that of any fungus I have seen. It has something of a suggestion of melilot, but the heavy sickening odor of the latter is relieved by a spicy, aromatic quality which makes the fragrance of this plant especially delightful. Two specimens of this plant filled a large laboratory with their odor for many weeks and even after twelve years a fragment of one of these plants still gives a distinct though faint odor. The species is known only from the original collection.

Hydnellum inquinatum sp. nov.

Hymenophore terrestrial, mesopodous, gregarious to confluent, light or dark-brown with light border, medium to large sized; pileus obconic, plane to depressed or subinfundibuliform, somewhat round or elliptical, 5–10 cm. wide, 0.4–1 cm. thick; surface somewhat uneven, sometimes wrinkled or irregularly corrugated, central portion of disk brownish to dark-brown becoming blackish with age, glabrous or subpubescent, sometimes pelliculose, with a more or less distinct border of whitish or isabelline wooly pubescence 1–2 cm. wide; margin obtuse, entire, substerile; substance in two layers, an upper spongy layer thickest at center and thinning out toward margin, and a lower hard, woody layer extending into and forming the core of the stem, sometimes transversely zonate, light-brown to pallid, hygrophanous, juice watery, colorless; stem central or excentric, short, with a spongy bulbous base, surface more or less uneven, dark-brown to blackish, subpubescent, 1–3 cm. long including the bulbous base, 0.7–1 cm. wide; teeth stout, somewhat compressed, often forked, obtuse to acute, shortening uniformily toward stem and margin, decurrent to the bulbous base, dark-gray-brown at base, lighter toward tip, 5 mm. or less long, 0.1 mm. wide, 6–8 to a sq. mm.; spores brown or fuscous, ovoid, coarsely tuberculate, $4 \times 5\,\mu$ wide; hyphae in the compact portions hyaline, smooth, somewhat thin-walled, collapsing when dried, recovering quickly in KOH, running longitudinally and interwoven, somewhat easily separable in KOH, septate with simple clamp-connections, segments extremely long, slender, uniform, with many guttulae, $4–5\,\mu$ wide, branching diffuse, both filaments septate a little above origin of branch, but only main filament with clamp-connection; in spongy portions hyphae thin-walled, collapsing and not recovering much in KOH, forming an intricate tangle and not separating easily in KOH, septate without clamp-connections and without guttulae, in other respects as the former; odor pleasant somewhat farinaceous, not strong; taste mild.

On ground under hemlocks, in late summer.

The type specimens were collected by the writer near Bolton, N. Y., and are in his herbarium. Specimens of what appear to be the same have been seen from New York, *Underwood*, and from New Hampshire, *Wilson*.

Hydnellum Peckii sp. nov.

Hymenophore terrestrial, mesopodous, gregarious to subconfluent, whitish to brownish gray, small to medium sized; pileus subobconic, plane to depressed, inclined, somewhat round to irregular, 2–5 cm. wide, 2–5 mm. thick; surface uneven, whitish pubescent when young, becoming glabrous and brownish-gray extending from the center finally to the margin; margin thin, acute, substerile, curling, uneven; substance tough, fibrous, compact, somewhat woody when dry, sometimes with a little spongy layer above at center, light-brown or isabelline; stem central, short, tapering downward into a spongy bulbous base, uneven, pubescent, dark-brownish, about 0.5 cm. long, 4–8 mm. wide, the bulbous base 1–1.5 cm. wide by 2–2.5 cm. long; teeth slender, terete, tapering, acute, shortening uniformly toward stem and margin, dark gray-brown at base, lighter at tip, 3 mm. or less long, 0.25–0.35 mm. wide, 7–9 to a sq. mm.; spores brown or fuscous, slightly tuberculate or angular, subglobose to ovoid, 4–5 μ wide; hyphae hyaline, smooth, somewhat thin-walled, collapsing when dried, recovering quickly in KOH, running longitudinally in compact portion and forming an intricate tangle in spongy portion, easily separable in KOH, slender, uniform, septate with simple clamp-connections, segments extremely long, 3.5–4 μ wide, branching diffuse, both filaments septate, with or without clamp-connections a little above origin.

On ground in woods, in autumn.

The type specimens were collected at North Elba, N. Y., by C. H. Peck, state botanist of New York, after whom the species is named. The specimens are in the writer's herbarium and a portion of the same collection is in the New York state herbarium at Albany. The species is not known outside of the original collection.

Hydnellum geogenium (Fries)[6]

Hydnum geogenium Fries, Ofv. Kongl. Vet. Ak. Forh. **1852**: 127. 1852.

Hydnum sulphureum Kalchbrenner.[7]

The type specimen of the species is to be found at Upsala marked in Fries's handwriting " Hydnum geogenium Fries. Upsaliae." With it are specimens collected by Lindblad at Upsala in 1857, also specimens sent by P. A. Karsten from Mustiala in 1866. All of these agree in their characters and are identical with specimens collected by C. H. Peck in New York.[8] There appears to be no doubt that the species belongs in the genus *Hyd-*

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[6] It seems probable that this combination has already been made by Karsten but we have not been able to locate it.

[7] The name is cited by Fries, but we cannot find that the species has ever been described.

[8] Peck, Ann. Rept. N. Y. State Mus. **39**: 43.

nellum although the color is quite unusual and even the spores appear to be yellowish, but we have not seen a spore print. The spores are distinctly tuberculate and the substance of the plant is fibrous and tough.

No type specimen of *H. sulphureum* Kalch. has been seen, but a specimen so labelled from Kalchbrenner, collected in Hungary, was found at Upsala where it had been referred to *H. geogenium* by Fries and appeared to be identical with the type of the latter species in every respect.

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